



RESEARCH › RESEARCH SUMMARIES

Sharing our progress toward recovery

Research Summaries

Discover what the latest science from the RECOVER Initiative means for our ability to understand, diagnose, prevent, and treat **Long COVID**.

This page contains descriptions of findings from **RECOVER research studies**. These descriptions use plain language and a format that is easy to understand.

If you want to learn more about the scientific discoveries described here, you can also browse and search the complete list of **RECOVER Publications**.

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● EHR ■ ADULT

Clinical encounter heterogeneity and methods for resolving in networked EHR data: A study from N3C ×

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Using computer processing to make data from medical records easier to use in research

An electronic health record (EHR) is a digital medical chart that has health data like doctor visits, lab results, and other information. These data are useful for understanding trends in health information, including how Long COVID affects people. Because of this, EHR data from different settings can be difficult to compare and use in research.

Researchers from the National COVID Cohort Collaborative (N3C) looked at over 15 million EHRs from 75 hospitals and clinics. Their goal was to make data from different healthcare settings more compatible. To do this, they had to understand and describe how definitions of patient visits differ between healthcare settings so the EHR data from different healthcare settings would be compatible.

The researchers focused on identifying patterns in EHR data. They hoped these patterns would help them gain a better understanding of a patient's complete care experience, including:

- How long the patient received care
- The number and types of treatments and medical procedures the patient received
- The order in which the patient received these treatments and procedures

To detect these patterns, researchers created two sets of rules for computer processing of EHR data. These rules are called algorithms. The first algorithm allowed researchers to group EHR data in new ways to make it easier to understand how the information in an EHR is related and easier to analyze individual EHRs and to compare EHRs from different sources.

The second algorithm allowed researchers to identify when EHRs indicated that a patient had been admitted to the hospital. Better data



EHR data more consistent, manageable, and understandable. Algorithms like the two tested by these researchers can help other researchers enhance the quality of EHR data, making it more consistent and capable of producing important insights about conditions like Long COVID.

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● REVIEW ■ ADULT ■ PEDIATRIC

Immune mechanisms underlying COVID-19 pathology × and post-acute sequelae of SARS-CoV-2 infection (PASC)

Mohandas, S; Jagannathan, P; Henrich, TJ; et al., *eLife*

People who had COVID-19 may develop Long COVID, which is when someone may experience various health issues after having COVID. Many of these problems are due to a strong reaction to the SARS-CoV-2 virus by the immune system (the body's defense system that fights infections). This reaction can happen a long time after the virus is no longer in the body.

A healthy immune system can tell the difference between our body's healthy cells and the harmful ones that can make us sick. However, an overactive immune system can make mistakes and cause harm because it may attack healthy organs and tissues. The immune system response to diseases like COVID is complex and different for each person.

It is important to understand how the immune system works after having COVID for many different people, and this may require large, long-term studies. This paper reviews researchers' current knowledge and the gaps in their understanding about the immune response after a COVID

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● REVIEW ■ ADULT

Viral persistence, reactivation, and mechanisms of Long COVID ×

Chen, B; Julg, B; Mohandas, S; et al., *eLife*

This paper summarizes some work of the RECOVER Mechanistic Pathways Task Force. This group does research on what happens in body systems when people have Long COVID. In this study, the authors reviewed existing research about why and for how long SARS-CoV-2, the virus that causes COVID-19, stays in the body. The authors also reviewed research on whether SARS-CoV-2 might become dormant (inactive) and then reactivate later as part of its natural lifecycle. They discuss whether the amount of time the virus stays in the body, also known as the “persistence” of the virus, could be related to whether or not people develop Long COVID. They also describe what is known so far about this topic, what we still need to find out, and the types of research studies that may help answer these questions.

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● EHR ■ ADULT ◆ VACCINATION

Long COVID risk and pre-COVID vaccination in an EHR-based cohort study from the RECOVER Program ×

Brannock, MD; Chew, RF; Preiss, AJ; et al., *Nature Communications*

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used electronic health records (EHR) to study the effect of vaccination using EHR for two groups of people who had COVID. One group was based on clinic data and represented more than 47,000 people. In this group, 695 were diagnosed with Long COVID in clinics and more than 26,000 were fully vaccinated. The other group represented almost 200,000 individuals who had COVID. The researchers used a computer program to estimate who might have Long COVID in this group based on their medical and symptom information. In this group, more than 86,000 people represented were fully vaccinated. The researchers made sure that the people in the vaccinated and unvaccinated groups were as similar to each other as possible in terms of the same sex, age, race, and medical history.

To test whether vaccination lowered the chance of developing Long COVID, they made comparisons within each group. They used several different definitions of Long COVID and several different statistical tests to figure out whether vaccination status affected Long COVID. For both of the study groups and for all definitions of Long COVID and each statistical test in the analysis, the researchers got the same answer: people who were vaccinated before having COVID were less likely to develop Long COVID.

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● EHR ■ PEDIATRIC ◆ BROAD SYMPTOMS ◆ RISK FACTORS

Understanding pediatric Long COVID using a tree-based scan statistic approach: An EHR-based cohort study from the RECOVER Program ×

Lorman, V; Rao, S; Jhaveri, R; et al., *JAMIA Open*

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COVID). The researchers analyzed electronic health record (EHR) data to detect conditions and symptoms associated with pediatric Long COVID. The study identified multiple conditions and body systems associated with pediatric Long COVID related to many different organs, such as heart and lung problems.

This research is important because these findings use a data-driven approach to detect several new or under-reported conditions and symptoms that should be studied further. Researchers believe that further study may reveal the biological processes that cause these Long COVID symptoms and conditions.

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● EHR ■ ADULT ◆ HEALTH DISPARITIES

Racial/ethnic disparities in post-acute sequelae of SARS-CoV-2 infection in New York: An EHR-based cohort study from the RECOVER Program ×

Khullar, D; Zhang, Y; Zang, C; et al., *Journal of General Internal Medicine*

RECOVER researchers wanted to learn more about racial and ethnic differences in Long COVID. Researchers used patients' electronic health records (EHRs) to compare people who had COVID based on their race or ethnicity, whether they were hospitalized due to COVID, and whether they had any health problems related to Long COVID. They looked at data from over 60,000 adults from 5 healthcare systems.

The researchers found that Black and Hispanic adults were more likely to have symptoms of Long COVID compared to White adults – this was true for adults who were and were not hospitalized. The reason for these differences is unclear.

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● EHR ■ ADULT ◆ RISK FACTORS

Identifying environmental risk factors for post-acute sequelae of SARS-CoV-2 infection: An EHR-based cohort study from the RECOVER Program ×

Zhang, Y; Hu, H; Fokaidis, V; et al., *Environmental Advances*

RECOVER researchers wanted to find environmental risk factors of Long COVID by comparing the environment of people who had Long COVID to people who didn't have Long COVID. Environmental risk factors are things about where a person lives that raise their chance of having a health condition, such as air pollution and poor housing conditions. The researchers looked at data from electronic health records (EHRs) of more than 100,000 people in the New York City area and Florida.

The researchers found that people who lived in areas with higher levels of air pollution, more poverty, and less access to healthy food had a higher chance of getting Long COVID. People in the New York City area had different environmental risk factors than people in Florida.



Research Summary (PDF, 107 KB)

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● EHR ■ ADULT ◆ BROAD SYMPTOMS
◆ NEW-ONSET AND PRE-EXISTING CONDITIONS

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Zang, C; Zhang, Y; Xu, J; et al., *Nature Communications*

RECOVER researchers analyzed electronic health records (EHR) in order to define Long COVID. Researchers found up to 25 different symptoms that patients who had COVID were more likely to have than those who didn't have COVID. The symptoms were related to many different organs, such as memory loss, hair loss, and feeling tired. They found that certain types of Long COVID symptoms were more likely to happen in patients who were older, had more severe COVID, or had more health problems before they had COVID.

This research is important because the findings show that Long COVID affects many organs, and types of Long COVID symptoms differ between certain groups of patients. However, EHR findings are limited in that they can only look at data from the patients' past. In order to confirm these findings, future studies that follow patients' symptoms over time, into the future, are needed.

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● EHR ■ PEDIATRIC ◆ NEW-ONSET AND PRE-EXISTING CONDITIONS

Can multisystem inflammatory syndrome in children be managed in the outpatient setting? An EHR-based cohort study from the RECOVER Program ✕

Jhaveri, R; Webb, R; Razzaghi, H; et al., *Journal of the Pediatric Infectious Disease Society*

RECOVER researchers explored Multisystem Inflammatory Syndrome in Children (MIS-C), a Long COVID symptom where there is inflammation (swelling) of multiple organ systems. Researchers looked to see if MIS-C

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maintaining necessary functions. For example, your heart, arteries, and veins make up the Cardiovascular System--the system responsible for maintaining blood flow and delivering oxygen throughout the body.

Researchers were able to identify that in some patients, their MIS-C symptoms were mild enough to be treated at home and not require hospitalization. These results raise awareness that MIS-C can present in milder forms with the option to treat it at home if directed by a physician.

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